DOCUMENT RESUME

ED 061 558 CG 007 164

AUTHOR Mahoney, Michael J.; And Others
TITLE Covert Behavior Modification: An Experimental Analogue.
INSTITUTION Stanford Univ., Calif. Stanford Center for Research and Development in Teaching.
SPONS AGENCY Office of Education (DHEW), Washington, D.C.
REPORT NO TR-24
BUREAU NO BR-5-0252
PUB DATE Mar 72
CONTRACT OEC-6-10-078
NOTE 19p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Associative Learning; Behavior; *Behavioral Counseling; Behavior Change; Conditioned Response; *Covert Response; *Imagery; *Overt Response; Perception; *Reinforcement; Response Mode; Therapy; Thought Processes

ABSTRACT

Data are presented from two experiments investigating whether covert responses can be modified. Imagery was chosen as a target because of its significant role in behavior therapy techniques. Resent evidence on the facilitative effects of imagery in paired-associate learning suggested to the experimenters the use of performance on a paired-associate learning task (in which imagery was used as a mediator) to corroborate self-reports of covert responding (imaging). In an attempt to increase or decrease the frequency of imaging, subjects were either reinforced or punished for self-reports of specific associative methods. Data indicates predictable frequency changes in imaging as a function of external contingency arrangements. The authors interpret their findings as supporting an assumption of homogeneity regarding overt and covert behavior principles, most notably that covert behaviors are functionally related to their consequences. Clinical implications for behavior therapists are briefly discussed. (Author/TL)

ED 061558

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

SE 007 164

Stanford Center for Research and Development in Teaching

SCHOOL OF EDUCATION STANFORD UNIVERSITY

STANFORD CENTER
FOR RESEARCH AND DEVELOPMENT
IN TEACHING

Technical Report No. 24

COVERT BEHAVIOR MODIFICATION: AN EXPERIMENTAL ANALOGUE

Michael J. Mahoney, Carl E. Thoresen,
and Brian G. Danaher

School of Education
Stanford University
Stanford, California

March 1972

Published by the Stanford Center for Research and Development in Teaching, supported in part as a research and development center by funds from the United States Office of Education, Department of Health, Education, and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the Office of Education and no official endorsement by the Office of Education should be inferred. (Contract No. OEC-6-10-078, Component 1F.)

Introductory Statement

The Center is concerned with the shortcomings of teaching in American schools: the ineffectiveness of many American teachers in promoting achievement of higher cognitive objectives, in engaging their students in the tasks of school learning, and, especially, in serving the needs of students from low-income areas. Of equal concern is the inadequacy of American schools as environments fostering the teachers' own motivations, skills, and professionalism.

The Center employs the resources of the behavioral sciences--theoretical and methodological--in seeking and applying knowledge basic to the achievement of its objectives. Analysis of the Center's problem area has resulted in three programs: Teaching Effectiveness, Teaching Students from Low-Income Areas, and the Environment for Teaching. Drawing primarily upon psychology and sociology, and also upon economics, political science, and anthropology, the Center has formulated integrated programs of research, development, demonstration, and dissemination in these three areas. In the program on Teaching Effectiveness, the strategy is to develop a Model Teacher Training System integrating components that dependably enhance teaching skill. In the program on Teaching Students from Low-Income Areas, the strategy is to develop materials and procedures for engaging and motivating such students and their teachers. In the program on Environment for Teaching, the strategy is to develop patterns of school organization and teacher evaluation that will help teachers function more professionally, at higher levels of morale and commitment.

This report, as part of the Personal Competencies component in the program on Teaching Effectiveness, examines how imagery responses can be influenced in a controlled laboratory setting. The Personal Competencies component is concerned with creating techniques for assisting individuals, such as teachers, to use selected overt and covert responses in managing their actions.

Abstract

Data are presented from two experiments investigating whether covert responses can be modified. Imagery was chosen as the target behavior because of its significant role in behavior therapy techniques. Recent evidence on the facilitative effects of imagery in paired-associate learning suggested to the experimenters the use of performance on a paired-associate learning task (in which imagery was used as a mediator) to corroborate self-reports of covert responding (imaging). In an attempt to increase or decrease the frequency of imaging, subjects were either reinforced or punished for self-reports of specific associative methods. The data indicated predictable frequency changes in imaging as a function of external contingency arrangements. An analysis of differential recall performance substantiated subjects' self-reports by showing a consistent superiority on imaged (versus non-imaged) items. These findings are interpreted as supporting the homogeneity assumption regarding overt and covert behavior principles. Clinical implications are briefly discussed.

COVERT BEHAVIOR MODIFICATION: AN EXPERIMENTAL ANALOGUE

Michael J. Mahoney, Carl E. Thoresen,
and Brian G. Danaher

The modification of specific internal responses by behavioral techniques has only recently begun to receive attention in controlled empirical research. In their work on the instrumental conditioning of autonomic responses, Miller (1969; and with others, 1970) and Shapiro (for example, Shapiro, Tursky, Gershon, & Stern, 1969) have demonstrated that a variety of covert behaviors can be directly and significantly altered. Research in bio-feedback training (for example, Nowlis & Kamiya, in press) and autogenic training (Luthe, 1970) has also indicated that internal responses can be modified. Higher process covert behaviors, such as thoughts and images, have long been used by behavior therapists as treatment variables (for example, in desensitization, implosion, and covert sensitization). The therapeutic promise of positive and negative thoughts and images has been presented by Cautela (1970a, 1970b). Thoresen (in press) has discussed the use of several behavioral techniques for increasing "humanistic" behavior in the case of certain covert responses.

Controlled experimentation on the modifiability of covert cognitive behaviors has been modest, however, possibly owing in part to both methodological and ideological considerations (Mahoney, 1970). Homme (1965) was one of the first to recognize the need for work in this area. He followed the lead of Skinner (1963), among others, in giving credit to the homogeneity assumption--that overt and covert behaviors obey identical laws. Unfortunately, that assumption has never been empirically tested. Since by

---

Michael J. Mahoney has been appointed Assistant Professor of Psychology at Pennsylvania State University. Carl E. Thoresen is Associate Professor of Education at Stanford University. Brian G. Danaher is a graduate student in psychology at the University of Oregon.

The authors would like to thank G. C. Davison, A. Bandura, and G. H. Bower for their comments and suggestions.

A somewhat different version of this paper will appear in the Journal of Behavior Therapy and Experimental Psychiatry.

their very definition covert behaviors are unobservable, no direct evidence can be gathered on their functional relations. Thus the homogeneity assumption has persevered, and those few researchers who have delved into covert behavior modification have relied of necessity on the accuracy of self-reports.

The present study was an attempt to investigate the homogeneity assumption by means of a covert behavior whose occurrence could be reliably inferred from observable data. By manipulating the external consequences of that covert behavior, the investigators obtained evidence bearing on its modifiability. Imagery (I) was chosen as an ideal behavior for experimental purposes both because of its prominence in behavior therapy techniques and because of recent evidence showing I to be one of the few covert behaviors for which reliability checks are possible. Although no unequivocal physical index of I has been found, a performance index has been shown to be reliably related to it (Bower, in press). Numerous researchers have shown that I significantly facilitates recall performance when used as a mediator in paired-associate learning tasks (for example, Bower, 1970, in press; Paivio, 1969; Paivio & Yuille, 1967, 1969; Reese, 1965). Indeed, recall performance is dramatically greater with I than with any other form of mediation (such as repetition). Of course, self-reports of imaging were used in all of these studies. A highly replicable and unmistakable performance superiority has consistently been associated with self-reports of I in such experiments. It was therefore decided that imaging (I) would serve as a target behavior for modification and that recall performance on a paired-associate learning task would be used as a reliability check on the self-reported occurrence of it.

Experiment 1: Positive Reinforcement

Subjects

Subjects for the present study were drawn from an introductory psychology course at Stanford University. Although most subjects earned money from the experiment, its monetary potential was not advertised and all participants were asked to refrain from discussing the experiment with classmates. The experiment was described as one involving "verbal learning."

Procedure

Subjects in this experiment (four male, six female) were seated at a table in front of a one-way mirror through which their overt responses were monitored by the experimenter. A boxlike coin-dispensing apparatus occupied the right-hand corner of the table. Instructions for the experiment were delivered via a tape recorder. The experimenter operated both the tape recorder and the consequation apparatus (the coin dispenser) by remote control. The initial instructions introduced the experiment as an attempt to find out how people associate words. The specific procedure followed that of a standard paired-associate learning task: two nouns were associated and a later recall test presented the first member of a pair, whereupon the subject was required to recall its associate. The learning materials were four lists of fifteen paired associates that had been used in the previously cited research of Bower and his co-workers. The words of each pair were presented two seconds apart, with an 8-second interval between pairs. Each subject could use any of four associative methods: imagery (I), sentence, repetition, and other. These were designated on an answer sheet by the initials "I," "S," "R," and "O." When the subjects had chosen to associate a particular noun pair by one of the above methods, they were instructed to write the initial of the associative method on their answer sheet. This allowed the experimenter to monitor and, when appropriate, to provide a consequence for reported covert behavior.

After the initial instructions, a list of fifteen paired associates were presented. No consequences were given for self-reported cognitive behaviors in this phase of the experiment. Rather, it served to produce a baseline estimate of the frequency of various covert mediating responses.

Next, an intervention was announced by the following taped instructions:

> During the remainder of the experiment you will be awarded money whenever the method by which you choose to associate a noun pair corresponds to a preestablished standard. Notice that there is a large box located on the desk in front of you. A dime will be dispensed from the box whenever your choice of associative method is considered appropriate. Thus, for example, you might receive a dime for using the repetition method to associate a particular

> noun pair. Which method is appropriate may vary from pair to pair or list to list. You should attempt to earn as many dimes as possible and to vary your choice of associative method so as to maximize your earnings. You will, of course, be allowed to keep whatever money you have earned at the end of the experiment.

Depending on their self-reported baseline frequency of I behavior, subjects were assigned to one of two conditions. When baseline imaging was infrequent (less than 50 percent), they were assigned to an Imagery-Repetition-Imagery (IRI) condition. Conversely, subjects with high-frequency baseline imaging (greater than 50 percent) were assigned to a Repetition-Imagery-Repetition (RIR) condition. In each of these groups (N=5=5) the targeted covert behavior was reinforced, then extinguished, and then reinforced again. Thus during the second list of paired associates, IRI subjects received dimes for self-reported I. During the third list, they received dimes for self-reported R. On the final list, they were again rewarded for I responses. Conversely, after baseline, RIR subjects were rewarded for R responses, then I responses, and then R responses during lists two, three, and four respectively. The experimental paradigm was intended to parallel conventional research designs in the experimental analysis of behavior. After an initial frequency estimate of a specific (covert) behavior was obtained, conditions were imposed that were designed to successively increase, decrease, and again increase the targeted behavior. The four paired-associate lists corresponded to the phases of baseline, intervention, reversal, and re-intervention that characterize the empirical case study.

In accordance with their assigned conditions, subjects received dimes during the remainder of the experiment for self-reports of I or R behavior. A recall test for all 60 paired associates was then given. It was necessary to delay the recall test until the end of the experiment because previous research had indicated the irreversibility of I behavior once its recall superiority had been demonstrated (David G. Tieman, personal communication). Following the recall test, each subject was given his earnings and asked whether (1) he was aware of the experimental contingencies, and (2) he had been consistently honest in reporting the covert associative methods he had used.

Results

The results of the first experiment are presented in Figure 1. The mean frequency of self-reported I behaviors for each group reflects a

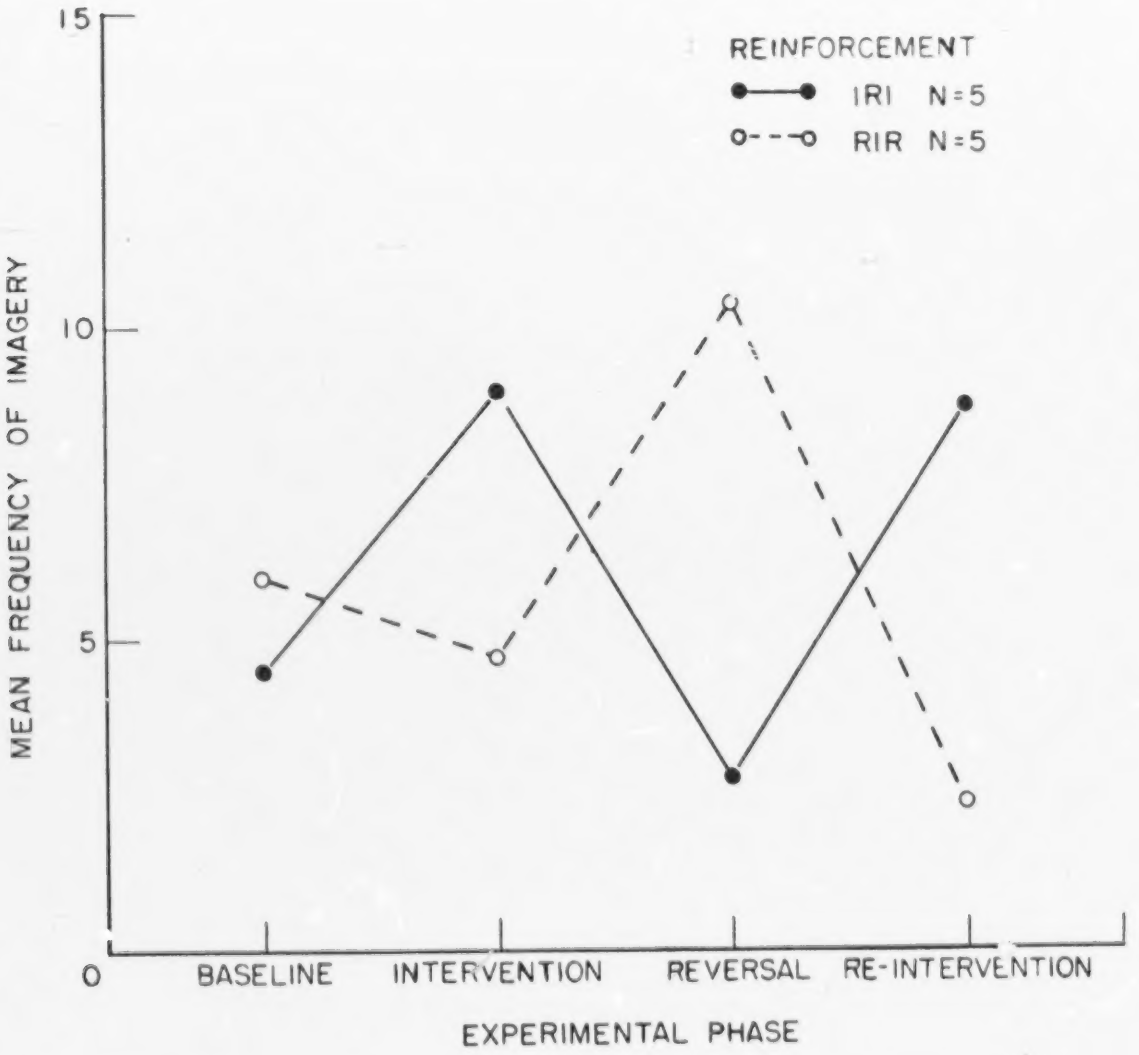

Fig. 1. Mean frequency of imaging when subjects were alternately reinforced for self-reports of imagery (I) and repetition (R).

predictable variation depending on experimental phase. Thus, for IRI subjects, I frequency increased during the reinforcement phase, decreased during reversal, and increased again when I reinforcement was resumed. Similarly, for RIR subjects, R frequency increased during both reinforcement phases and decreased during reversal. In three instances the coin-dispensing apparatus jammed, but subjects continued responding to its

buzz. It should be noted that the group curves presented in Figure 1 are very representative of individual response curves. However, as an illustration of inter-subject variability, Figure 2 shows the individual curves

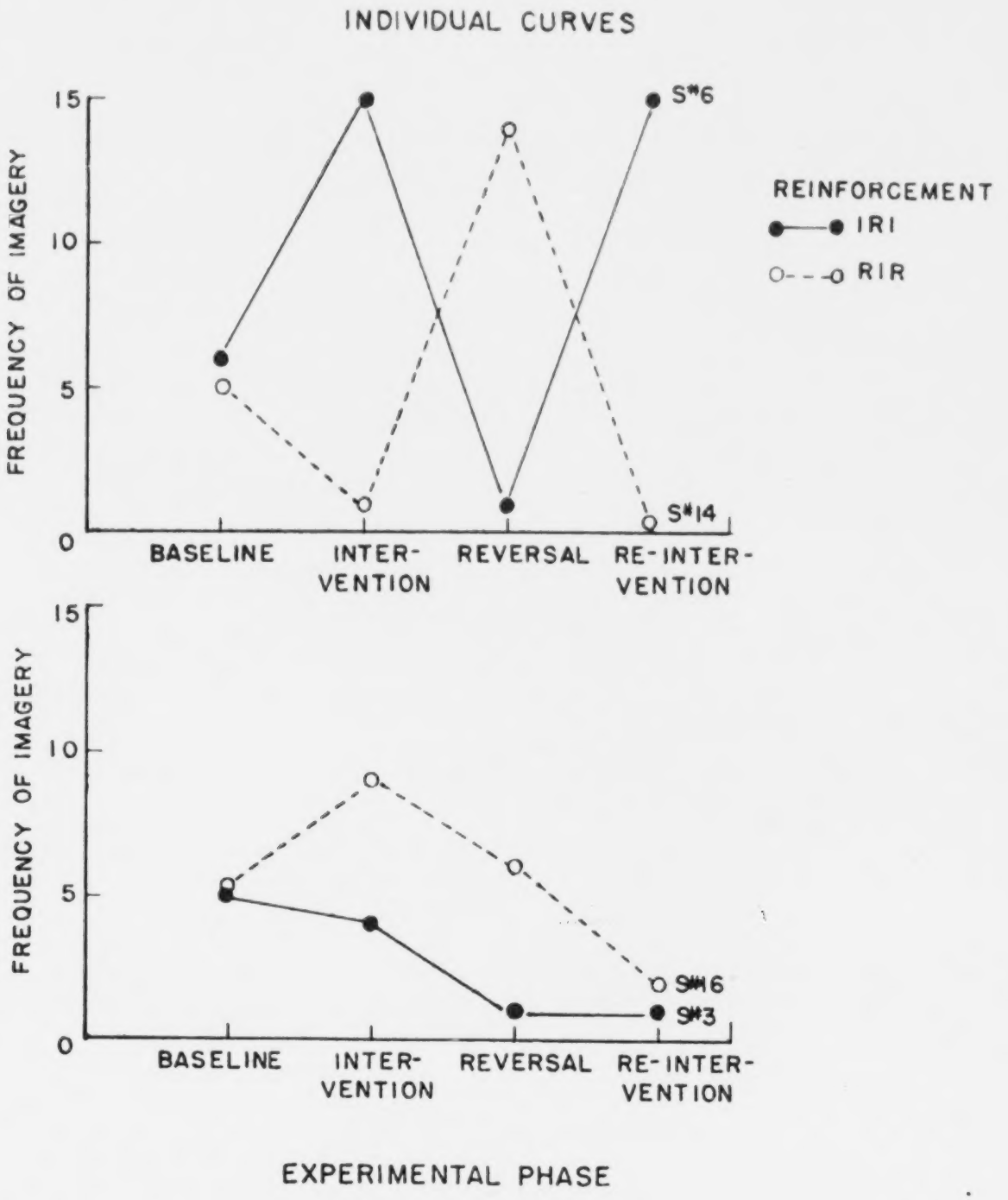

Fig. 2. Individual response curves of subjects whose performance conformed most (upper figure) or least (lower figure) to the reinforcement contingencies.

of subjects whose responding conformed most or least to the experimental contingencies. During debriefing, one of the nonconforming subjects (S #16) indicated that she had felt negative about being awarded money for her performance. Although considerable variability was seen in the magnitude of frequency changes, the direction of those changes was consistently in the predicted direction for individual subjects. A quantitative index of the correspondence between individual response curves and group response curves was obtained by comparing the number of predicted (directional) frequency changes with the number actually observed. Each subject's I behavior was expected to increase, decrease, and then increase (or the converse, depending on condition). With ten subjects, then, a total of 30 frequency changes in I behavior were expected. Of those 30, 23 were in the predicted direction. A sign test (Siegel, 1956) reveals these transitions to be significant at the .001 level (two-tailed).

The recall performance for each subject was evaluated by comparing the percentage of recall on imaged items to the percentage of recall on non-imaged items. All ten subjects showed superior recall for items associated by imagery (sign test $p < .002$, two-tailed). Considerable variability was observed in the relative superiority of I as an associative method. Over all ten subjects, I-recall averaged 40 percent, whereas non-I-recall averaged 22 percent. Most subjects reported that they had been aware of the experimental contingencies. Two individuals in the RIR condition said that they had occasionally reported I when they had in fact used some other associative method. A within-subject analysis of their recall difference (percentage of I-recall minus percentage of non-I-recall) revealed it to be considerably less than that of subjects who said they had been consistent in their self-reports of covert behavior (10.5 percent versus 24.7 percent, respectively). This result, of course, was to be expected if non-I-recall was being inflated by unreported imaging.

Experiment 2: Punishment

Subjects

Subjects were again recruited from an introductory psychology course at Stanford University.

Procedure

The general paradigm of Experiment 1 was employed, except that the subjects (six male, six female) were punished rather than rewarded for self-reports of I and R behavior in paired-associate learning. The associative methods were restricted to I and R in order to enhance the informative feedback of negative consequation. The paired-associate lists of Experiment 1 were used, and subjects were assigned to an IRI or an RIR punishment condition depending on the self-reported baseline frequency of the covert target behaviors. After baseline, the following taped instructions were presented.

> During the remainder of the experiment you will hear a noise whenever the method by which you choose to associate a noun pair corresponds to a preestablished standard. Notice that there is a large box located on the desk in front of you. The noise will come from that box whenever your choice of associative method is considered inappropriate. Thus, for example, you might hear the noise for using the repetition method to associate a particular noun pair. You are presently the recipient of $4.00 cash for signing up and attending today's experiment. Each time you hear the noise indicating you have chosen the inappropriate associative method, a quarter will be subtracted from your $4.00. Which method is inappropriate may vary from pair to pair or list to list. You should attempt to maintain as much of your $4.00 as you can and to vary your choice of associative method in such a way as to maximize your earnings. You will, of course, be allowed to keep whatever money you have earned at the end of the experiment.

Thereafter, the consequation apparatus was operated whenever the targeted behavior was reported. IRI subjects were punished for imaging on the second list, for repeating on the third, and for imaging on the fourth. Conversely, RIR subjects were punished for repeating on the second and fourth lists, and for imaging on the third. The recall test and debriefing procedures of Experiment 1 were employed.

Results

The results of the second experiment are presented in Figure 3. Again group curves are employed for simplicity and because of the remarkable correspondence between individual and group performances. The de-

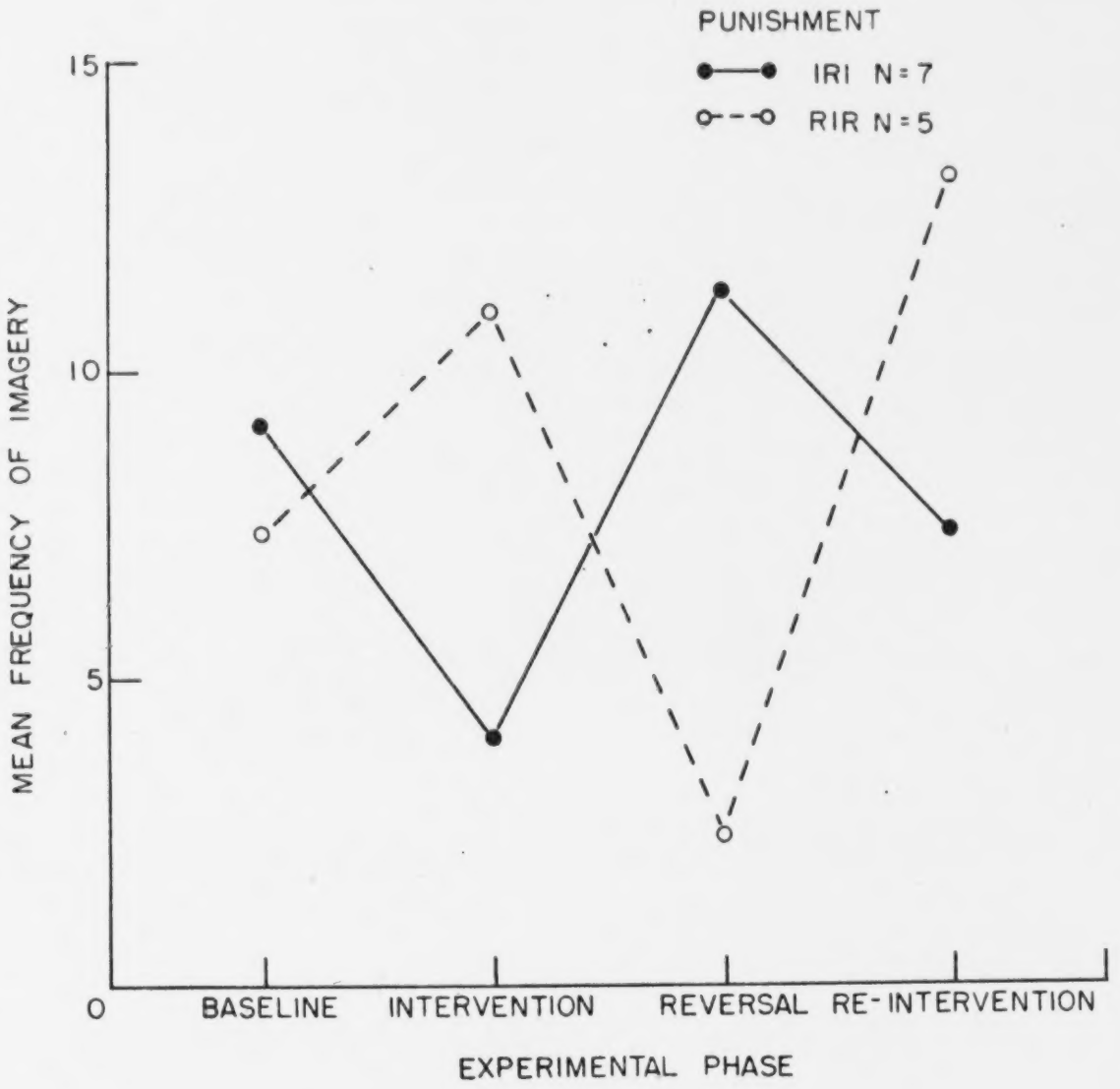

Fig. 3. Mean frequency of imaging when subjects were alternately punished for self-reports of imagery (I) and repetition (R).

gree of variability between subjects is illustrated in Figure 4, which depicts the two most extreme individual performances in each group. The least conforming subject (S #9) indicated during debriefing that he had

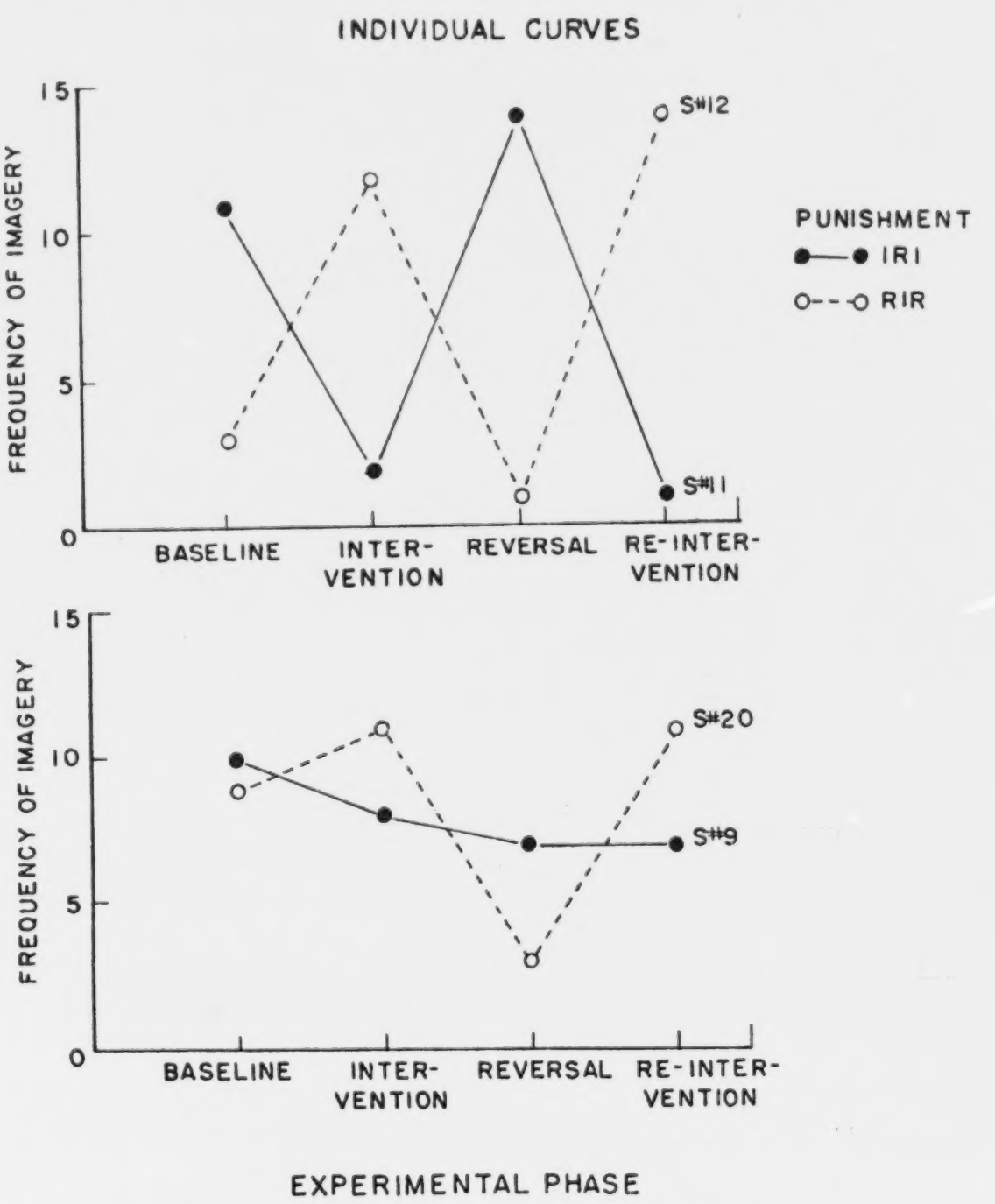

Fig. 4. Individual response curves of subjects whose performance conformed most (upper figure) or least (lower figure) to the punishment contingencies.

intentionally responded in a way contrary to the contingencies to show that "he wasn't so easily managed." It is interesting to note the consistency with which all other punishment subjects performed. The twentieth subject, the least conforming RIR subject, responded very consistently with experimental conditions. Likewise, the correspondence between the reinforcement and punishment data are striking (compare Figures 1 and 3). Of the 36 predicted I changes for individual subjects, 34 were in the expected direction (sign test $p < .001$, two-tailed). A within-subject comparison of I-recall showed it to be superior in 11 of 12 cases (sign test $p < .001$, two-tailed). The recall difference for the twelfth subject was zero. Averaged across individuals, I-recall was 42 percent as compared to 25.5 percent for R-recall. As in Experiment 1, most subjects were able to describe the experimental contingencies at debriefing. Two of the IRI punishment subjects reported that they had occasionally marked I when they were in fact using R as an associative method. Four other IRI subjects admitted having frequently misrepresented their covert behavior. An analysis of their recall difference revealed that highly misrepresentative subjects showed the least difference in recall performance (20.5 percent). Subjects reporting occasional misrepresentations showed a moderate difference (25.0 percent), and the single IRI subject who said he had been consistent in his self-reports showed the greatest difference (27.0 percent).

Discussion

The foregoing results lend support to the contention that covert behaviors are functionally related to their consequences. The covert response class of I, it was shown, could be both acceleratively and deceleratively manipulated by means of external contingency arrangements. Although changes in the frequency of imaging were inferred from subjects' self-reports, concurrent changes in recall performance support the conclusion that some consistent change in cognitive behavior was taking place. A peripheralist interpretation of the present results--that is, that the behavior modified was that of writing the letter "I" on a piece of paper--would not satisfactorily explain why the peripheral response of

writing "I" was consistently associated with superior recall performance. A counterbalanced order of accelerative and decelerative manipulations across experiments controlled for such variables as primacy, recency, interference, and specific pair difficulty.

The fact that 36 percent of the subjects in this study reported having misrepresented their covert responses at least once suggests the need for further investigation. Although the superiority of I-recall made it possible to substantiate self-reports, the tendency to misrepresent covert responses could prove troublesome in situations of less experimental control. One possible explanation for the degree of misrepresentation by subjects in the present study is that repetition (R) can become a boring mode of associative learning. This speculation is suggested by the research of Paivio and Yuille (1969), who found that subjects soon tired of R as a mediating response. Further research on this issue is also needed.

The present study has two implications for covert behavior modifiers: (1) some cognitive behaviors can be modified by their consequences, and (2) overt behavioral indices may be very helpful in assessing the magnitude and accuracy of self-reported changes in covert responding. These findings substantiate previously reported attempts to modify covert behaviors. They also lend support to the homogeneity assumption regarding overt and covert behavior principles.

Given the clinical utility of imagery responses (Cautela, 1969) and the functional relationship between covert behaviors and overt performance, the present evidence would seem to have direct bearing on therapeutic techniques in behavior modification. Since covert responses play a significant role as reinforcers, punishers, and discriminative cues for other (often overt) responses, their modifiability is of major concern for adaptive behavior change. Moreover, cognitive forms of self-control have shown themselves to be therapeutically promising (cf. Mahoney, 1972; Thoresen & Mahoney, in press). Finally, the fact that imagery responses were demonstrated to be significantly manipulable in this study suggests the possibility that cases of imagery deficit may be amenable to treatment. For example, planned learning experiences for the strengthening

of vivid multi-sensory (e.g., visual, auditory, olfactory) imagery may be possible (Danaher & Thoresen, 1972; Phillips, 1971). What with the important role played by imaginal and cognitive responses in behavior therapy, this latter implication is a welcome one.

By demonstrating an experimental analysis of covert behavior, it is hoped that the present study will encourage further attempts to bring empirical research talents to bear on the area of covert behavior modification.

References

Bower, G. H. Analysis of a mnemonic device. American Scientist, 1970, 58, 496-510.

Bower, G. H. Mental imagery and associate learning. In L. Gregg (Ed.), Cognition and learning in memory. New York: Wiley, in press.

Cautela, J. R. The use of imagery in behavior modification. Paper presented at the annual meeting of the Association for Advancement of Behavior Therapy, Washington, D.C., 1969.

Cautela, J. R. Covert conditioning. Paper presented at the Conference on the Study of Private Events, University of West Virginia, Morgantown, 1970. (a)

Cautela, J. R. Covert reinforcement. Behavior Therapy, 1970, 1, 33-50. (b)

Danaher, B. G., & Thoresen, C. E. Imagery assessment by self-report and behavioral measures. Technical Report No. 27. Stanford, Calif.: Stanford Center for Research and Development in Teaching, 1972.

Homme, L. E. Perspectives in psychology, XXIV. Control of coverants, the operants of the mind. Psychological Record, 1965, 15, 501-11.

Luthe, W. Autogenic training: Research and theory. Vol. 4. New York: Grune & Stratton, 1970.

Mahoney, M. J. Toward an experimental analysis of coverant control. Behavior Therapy, 1970, 1, 510-21.

Mahoney, M. J. Research issues in self-management. Behavior Therapy, 1972, 3, 45-63.

Miller, N. E. Learning of visceral and glandular responses. Science, 1969, 163, 434-45.

Miller, N. E., DiCara, L. V., Solomon, H., Weiss, J. M., & Dworkin, B. Learned modifications of autonomic functions: A review and some new data. Circulation Research, 1970, 26-27, 3-11.

Nowlis, D., & Kamiya, J. The control of electroencephalographic alpha rhythms through auditory feedback and associated mental activity. Psychophysiology, in press.

Paivio, A. Mental imagery in associative learning and memory. Psychological Review, 1969, 76, 241-63.

Paivio, A., & Yuille, J. C. Mediation instructions and word attributes in paired-associate learning. Psychonomic Sciences, 1967, 8, 65-66.

Paivio, A., & Yuille, J. C. Changes in associative strategies and paired-associate learning over trials as a function of a word imagery and type of learning set. Journal of Experimental Psychology, 1969, 79, 458-63.

Phillips, L. W. Training of sensory and imaginal responses in behavior therapy. In R. D. Rubin, H. Fensterheim, A. A. Lazarus, & C. M. Franks (Eds.), Advances in behavior therapy. New York: Academic Press, 1971.

Shapiro, D., Tursky, B., Gershon, W., & Stern, M. Effects of feedback and reinforcement on the control of human systolic blood pressure. Science, 1969, 163, 588.

Siegel, S. Nonparametric statistics for the behavioral sciences. New York: McGraw-Hill, 1956.

Skinner, B. F. Behaviorism at fifty. Science, 1963, 140, 951-58.

Reese, H. W. Imagery in paired-associate learning in children. Journal of Experimental Child Psychology, 1965, 2, 290-96.

Thoresen, C. E. Behavioral humanism. Research and Development Memorandum No. 88. Stanford, Calif.: Stanford Center for Research and Development in Teaching, in press.

Thoresen, C. E., & Mahoney, M. J. Behavioral self-control. New York: Holt, Rinehart and Winston, in press.